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(54) Cartridge for removable or portable circuit cards.

(57) An extension module 40 is provided for tandem connection to a base circuit card 1 having an external sheet material jacket 4 girding said card. The module includes a module housing 4a, 4b and a pair of spaced apart parallel support fingers 45 extending from the housing. The outer sides of said support fingers are configured for slidable insertion into corresponding spaced apertures 50 in the rearward end of the base circuit card to engage inner surfaces of the jacket adjacent opposite side edges of the jacket of the card. An electrical connector 49 is located between the support fingers and is adapted for mating connection with a corresponding electrical connector 3 located at the rearward end of the base circuit card, when the extension module is connected to the base circuit card. When the extension module is connected to the base circuit card by substantially full insertion of the support fingers into the base circuit card the engagement of said jacket embracing the fingers rigidly joins the extension module to the base card to form an integral extended circuit card.

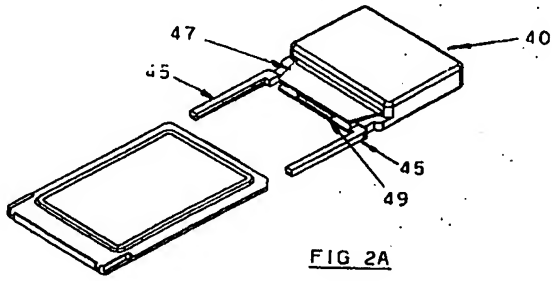

FIG 2A

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rear section that can be considerably thicker than the front portion of the card. Although substantially all of the front portion of the card could be inserted into an electronic device such as a computer for use the rear portion can be quite bulbous and is not conveniently housed within the electronic device with which it is intended to be used. Accordingly when an extended card is in use the rear portion of the card is exposed to possible stresses or damage while in use, (unlike the nonextended version) so it is important that the entire card is strongly constructed, preferably in a unitary structure.

While it is possible to manufacture a circuit card satisfying the PCMCIA standard version 2 in a single unit; this would require a completely new and different assembly line than required for a version 1 or 2 non-extended card. Accordingly it appears useful to construct an extended card in two sections that can be joined together in tandem to produce the final extended card. The front or base portion of the card could be made on an assembly line designed to handle the non-extended cards, and the extensions could be assembled on an additional assembly line or contracted to a vendor. In addition the base portion could be designed to provide basic electronic and memory functions while the extensions could be designed for specific functions such as LAN communications, infrared communications, audio functions, etc., to work with and complement the functions provided by the base. In this manner customized extended card assemblies could be produced without the necessity of constructing a different full extended card for each function. One base card could be used with ally one of a number of extension cards.

Electrical and mechanical connection of circuit cards is known in the literature; however because of the small size of the circuit cards conforming to the PCMCIA standards the applicant was not able to find any connection means capable of providing secure mechanical and electrical connection between components of the card system while providing a rugged supporting connection between base and extension components.

U.S. Patent 5,113,317 issued May 12, 1992 to Allen-Bradley Company describes a piggy-back support for an auxiliary circuit card so that one card may be inserted along rails contained on one side of a host card to provide support for the auxiliary card. This reference does not appear useful in the PCMCIA circuit card field because of the extra thickness required by the piggy-back configuration.

U.S. Patent 4,941,841 issued July 17, 1990 to Julius Darden et al describes an adapter and removable slide-in cartridge for an information storage system. The apparatus disclosed in this reference forms a fairly bulky system compared to the size range required in the PCMCIA circuit card field.

U.S. Patent 4,179,178 issued Dec. 18, 1979 to RCA Corporation describes a plug in circuit cartridge with electrostatic charge protection which uses a pair of actuator pins which extend beyond an electrical connector to engage corresponding apertures in a mating assembly to contact a shield device on the mating assembly to raise the shield to permit engagement of the electrical connector. There is no disclosure of the connection of one cartridge to another. The apparatus disclosed is designed to connect a portable cartridge such as a video game cartridge to an electronic device such as a player capable of using it.

Disclosure of the Invention

It has been found that the invention herein overcomes the deficiencies of the prior art while providing a compact tandem circuit card assembly which is convenient from a manufacturing perspective and which is physically durable even if constructed in accordance with PCMCIA standards.

An extension module is provided by one embodiment of the present invention for tandem connection to a base circuit card. The extension module includes a module housing, a pair of spaced apart parallel rigid support fingers extending from the housing, the support fingers being configured for sliding insertion into corresponding parallel sockets in the base circuit card. An electrical connector located between said support fingers is adapted for mating connection with a corresponding electrical connector located at the rearward end of the base circuit card when the extension module is connected to the base circuit card. When the extension module is connected to the base circuit card by substantially full insertion of the support fingers into the base circuit card sockets the engagement of said sockets with the fingers rigidly joins the extension module to the base card to form an integral extended circuit card.

Brief Description of the Drawings

An example of one embodiment of the invention will now be described with reference to the accompanying drawings in which:

Fig. 1 composed of Figures 1a and 1b provides perspective views of an assembled extended card;

Fig. 2 composed of Figures 2a, 2b, 2c provides perspective view of the separated sections of an extended card, such as that shown in Fig. 1;

Fig. 3 is a perspective view of an assembled base card;

be advantageously incorporated on the interior of each cover to protect internal components.

The partial perimeter frame 6, which is shown in more detail in Fig. 5, has a number of functions and features. It functions as a carrier for circuit board 7 during the final stages of assembly and testing of the card. It importantly also functions as an internal arbor for locating covers 4a, 4b during assembly to control their alignment for the joining of the covers together. Recessed portions 17 along the sides of the frame, and recesses 19 at the front end of the frame provide this alignment function.

In addition, the top (and likewise the bottom) surface 20 of the frame is recessed below protective edges or curb portions 21 of the edges of the frame. These curbs provide two functions. Curb portions 21 (along the sides of the frame adjacent the position that will be occupied by connector 3), and a similar curb 24 extending along the outer end of connector 3 (see Fig. 4) serve to conceal the unbent edges of covers 4a, 4b from exposure so that the covers can lay below or flush with these frame curbs. If the covers are set below the curbs a degree of protection will be given to artwork present on surfaces of the covers.

Corners 27 in general provide external shock absorbing material to reduce or prevent damage if the card is dropped. The corners also eliminate the need to draw the corners of the covers during their forming stage greatly reducing cost. The covers can therefore be produced by simple cutting and bending techniques that are well known.

Figure 6 shows the covers and circuit module in spaced proximity to each other before assembly.

One process that has been found successful for the assembly of a base card 1 in accordance with the invention herein using components referred to in Figs. 4 and 5 is as follows:

1. A sub-assembly consisting of circuit board 7, and connector 3 is placed inside the bottom stainless steel cover 4b. The walls 13b, 14b, 29b of the cover extend upwards only half the thickness of the final assembly leaving the upper half of the sub-assembly exposed.
2. The top stainless steel cover 4a is placed over the remaining exposed sub-assembly, its walls 13a, 14a, and 29a resting on the corresponding upstanding walls 13b, 14b, and 29b of the lower cover.
3. This assembly is then placed inside a laser welding fixture which provides a limited clamping force so that the edges of both top and bottom cover remain touching. This fixture also advantageously provides a horizontal rotary action so that all four sides of the assembly can be exposed to a beam from a suitable laser for welding.
4. The laser beam is then activated to weld the edges of the covers on one side. Welds are done under a covering blanket of Argon gas. When the side is done the fixture is rotated and the next side is welded. When all sides are completed the finished welded card 1 is removed.

Laser welding is particularly suitable for joining the covers as the welding beam can be accurately controlled in energy level, pulse rate, beam size; and depth can be accurately maintained to provide a homogeneous joint 28 without penetrating beyond the stainless steel cover thickness, thus preventing damage to the plastic frame while achieving complete fusion of all abutting wall edges.

As laser welding and apparatus for achieving it are well known no additional details will be provided for the welding process or apparatus.

The welding operation produces a one-piece sheet metal jacket of substantial rigidity which girds the frame and protects its internal components.

While laser welding has been found suitable for the stainless steel described above, other joining techniques capable of producing strong continuous or homogeneous fusion such as brazing may be satisfactory depending on the materials selected.

In the rectangular form depicted the jacket essentially takes the shape of a flattened boxbeam.

Referring to Fig. 3 it can be seen that upper and lower portions of the jacket extend as plates 15 (shown in Fig. 4C) to cover opposite sides of the connector. The ends of the extension plates 15 are joined together by straps 29 set in recesses of connector 3 to maintain the integrity and strength of the jacket and card.

As may be seen the extension plates 15 are somewhat narrower than the rest of the jacket to allow for projection of portions of the perimeter frame in which polarization grooves 25 have been formed to assure correct insertion of the card in cooperative external equipment.

The embodiment described above provides a durable base card that can be assembled without adhesive being required on the frame or component parts to acquire strength. This has the advantage of reducing the stresses that can be exerted on the circuit board or its components which could otherwise contribute to deterioration of electrical joints and components. In addition, as no adhesive is present, the effect of heat and humidity on adhesive do not become limiting factors on card durability.

Referring to Figures 1, 2, and 7 a preferred embodiment of the extension module of the invention will be described. Referring to Fig. 2 the base card 1 (shown in Fig. 1) and extension module 40 are shown in proximity to each other prior to interconnection. Module 40 is composed of an upper

gers (45) rigidly joins said extension module (40) to said base card (1) to form an integral extended circuit card.

2. An extension module (40) as claimed in claim 1 having an external sheet material jacket (4) girding said card (1) and wherein:

the outer sides of said support fingers (45) are configured to engage inner surfaces of the jacket (4) adjacent opposite side edges of said jacket (4) of said card (1); and

the engagement of said jacket (4) embracing said fingers (45) rigidly joins said extension module (40) to said base card (1) to form an integral extended circuit card.

3. An extension module (40) as claimed in claim 2 enclosing a circuit board (7) spaced from the corresponding inner surfaces of opposite side edges of the jacket (4), wherein opposed inner surfaces of said fingers (45) are grooved (46) longitudinally to embrace transverse edges of the circuit board (7) contained within said base circuit card (1).

4. An extension module (40) as claimed in any preceding claim wherein said electrical connector (49) of said extension module (40) is shielded by spaced apart upper and lower extension lips (47) shielding upper and lower sides of the electrical connector (49), said lips (47) being positioned to partially cover a portion of the upper and lower surfaces of said base circuit card (1) when said extension module (40) is fully connected to said base card (1).

5. An extension module (40) as claimed in any preceding claim further comprising latching means (51) on said extension module (40) for cooperative engagement with a complementary latching structure (14) on said base circuit card (1) to lock said extension module (40) to said base circuit card (1) when they are connected together.

6. An extension module (40) as claimed in claim 5 wherein said latching means (51) comprises a spring loaded pin adapted to engage a tab on said base circuit card (1).

7. An extension module (40) as claimed in claims 1, 2, or 3 wherein said support fingers (45) are comprised of a suitable flex resistant material selected from the group comprising aluminum alloy, zinc alloy, magnesium alloy, Thermoset plastic, and graphite plastic composite.

8. An extended circuit card assembly comprising an extension module (40) and a base circuit card (1) wherein said extension module (40) comprises:

a module housing (40a, 40b);

a pair of spaced apart parallel support fingers (45) extending from said housing, said support fingers (45) being configured for sliding insertion into corresponding parallel sockets having insertion apertures (50) at the rearward end of said base circuit card (1); and

an electrical connector (49) located between said support fingers (45) adapted for mating connection with a corresponding electrical connector (3) located at the rearward end of said base circuit card (1) when said extension module (40) is connected to said base circuit card (1);

whereby when said extension module (40) is connected to said base circuit card (1) by substantially full insertion of said support fingers (45) into said base circuit card sockets the engagement of said sockets with said fingers (45) rigidly joins said extension module (40) to said base card (1) to form an integral extended circuit card.

9. An extended circuit card assembly as claimed in claim 8 wherein:

said extension module (40) is adapted for tandem connection to a base circuit card (1);

said base circuit card (1) has an external sheet material jacket (4) girding said card (1);

the outer sides of said support fingers (45) are configured to engage inner surfaces of the jacket (4) adjacent opposite side edges of said jacket (4) of said card (1); and

the engagement of said jacket (4) embracing said fingers (45) rigidly joins said extension module (40) to said base card (1) to form an integral extended circuit card.

10. An extended circuit card assembly as claimed in claim 9 wherein said extension module (40) encloses a circuit board (7) spaced from the corresponding inner surfaces of opposite side edges of the jacket (4), wherein opposed inner surfaces of said fingers (45) are grooved (46) longitudinally to embrace transverse edges of the circuit board (7) contained within said base circuit card (1).

11. An extended circuit card assembly as claimed in claim 10 wherein said base circuit card (1) comprises:

a circuit module including:

a partial perimeter frame (6);

a circuit component circuit board (7) car-

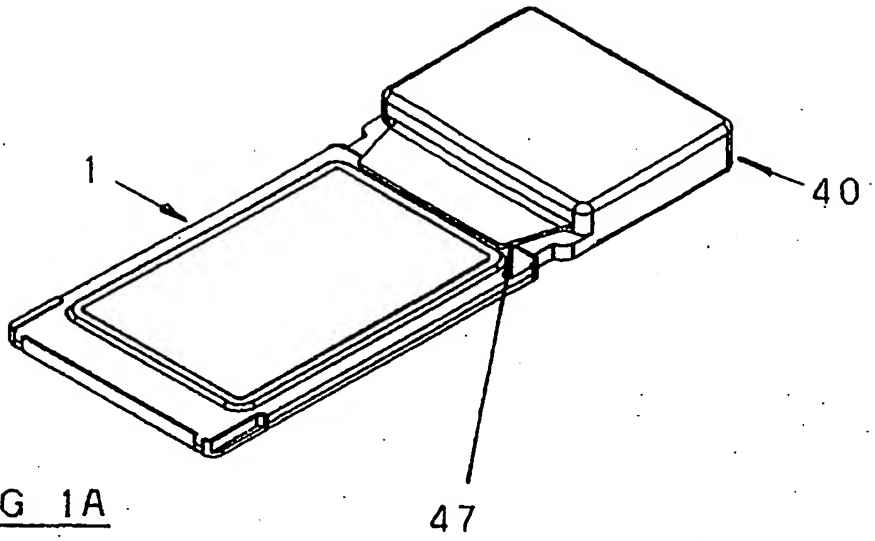

FIG 1A

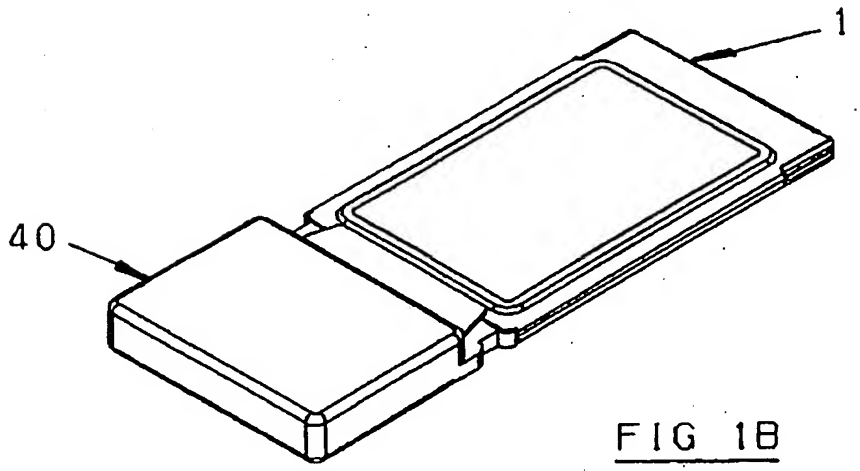

FIG 1B

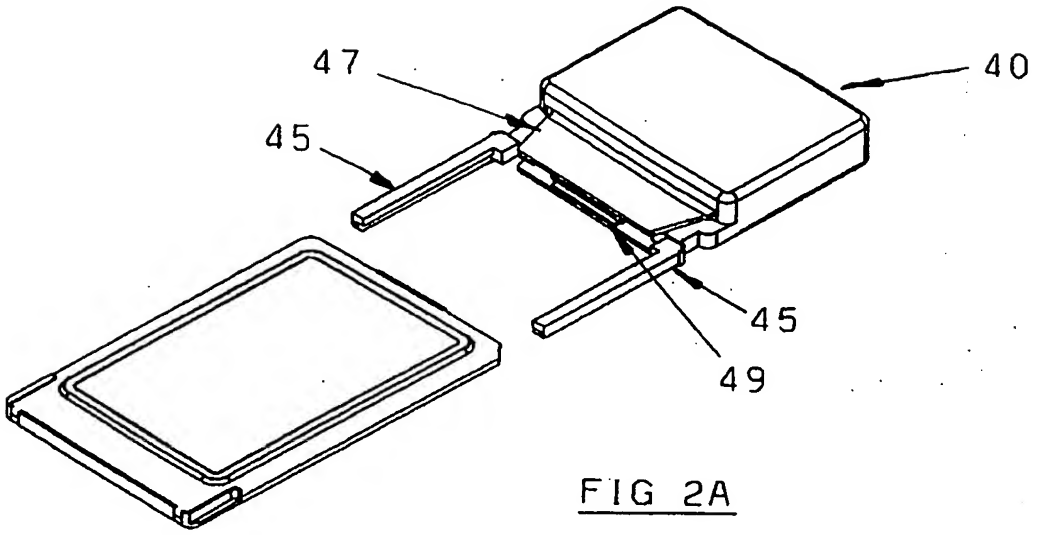

FIG 2A

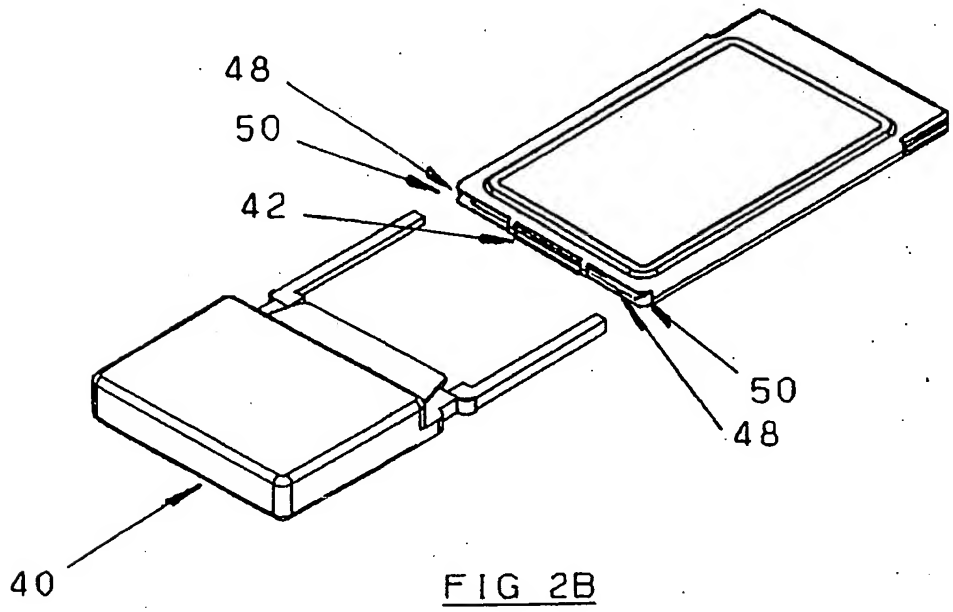

FIG 2B

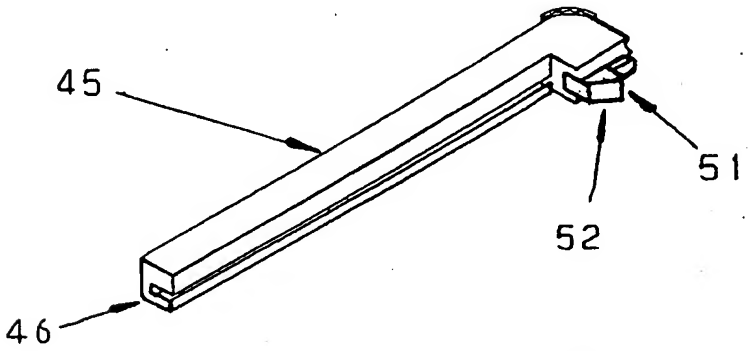

FIG 2C

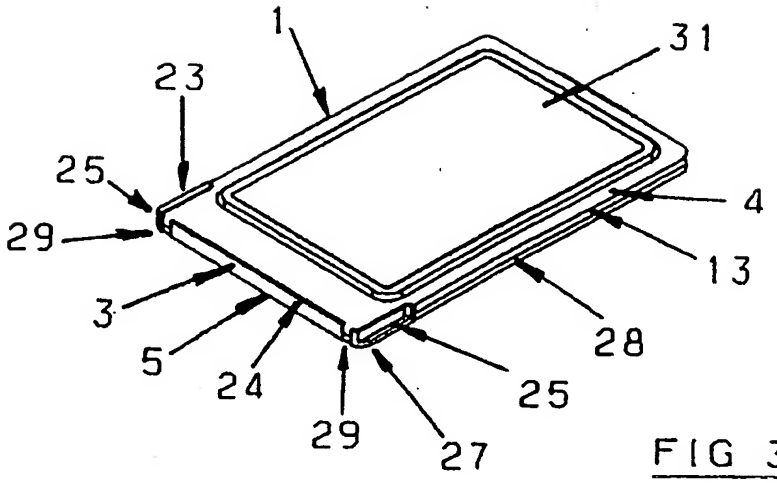

FIG 3

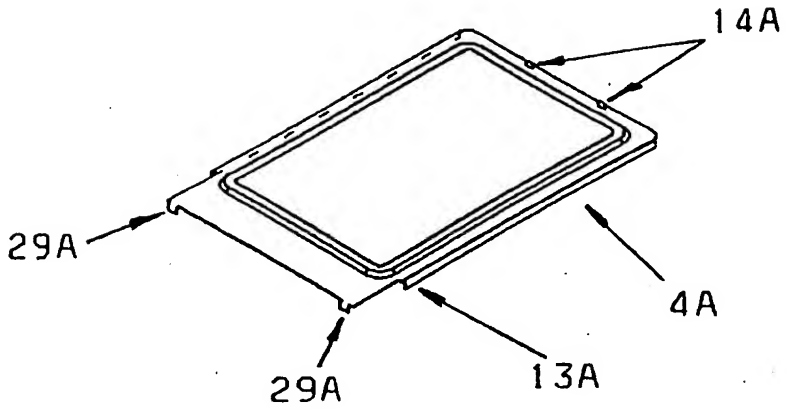

FIG 4A

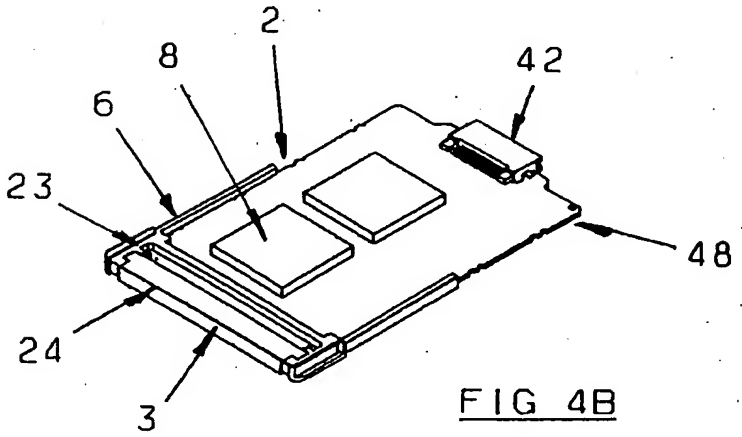

FIG 4B

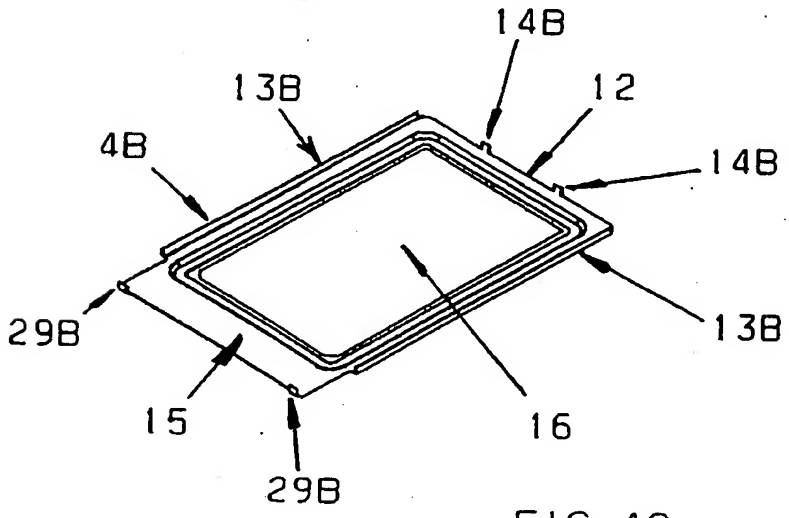

FIG 4C

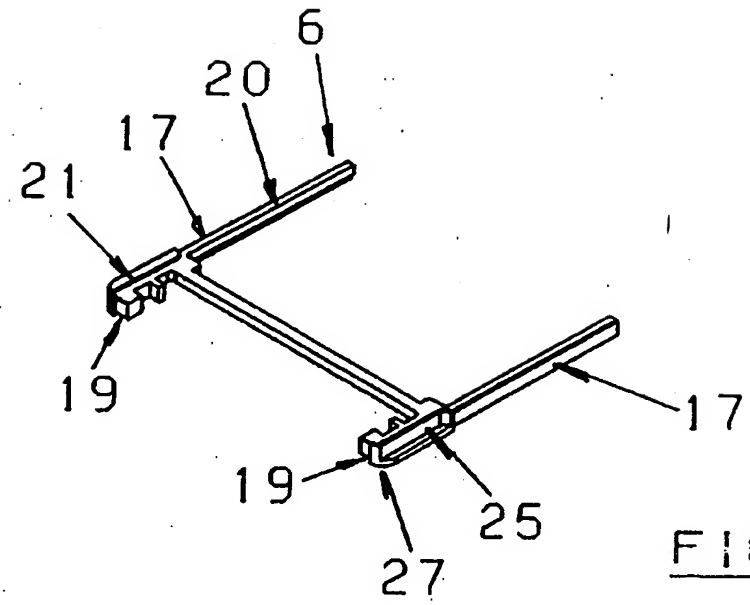

FIG 5

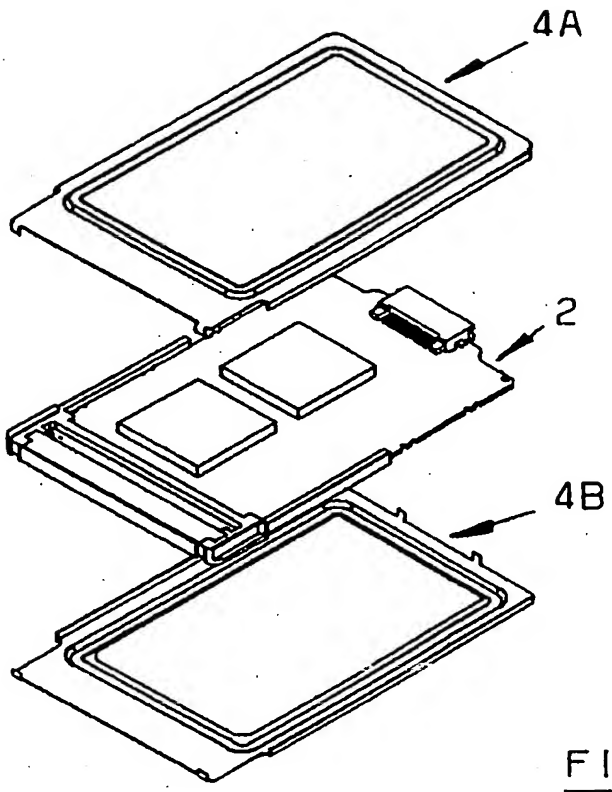

FIG 6

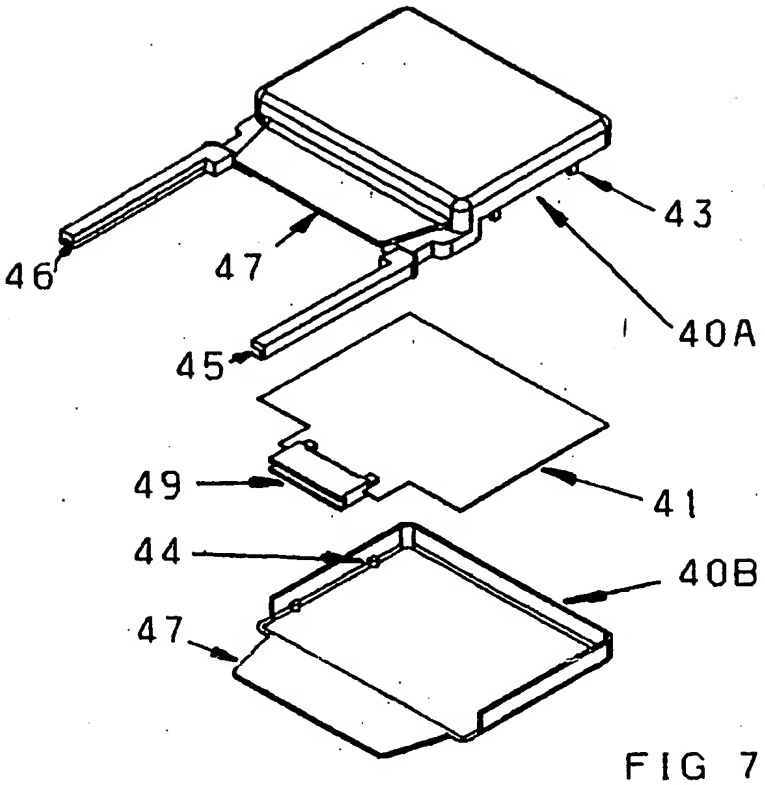

FIG 7